

Appl. No. 10/783,495  
Amtd. dated 03/05/2008  
Response to Office action of 11/05/2007

Attorney Docket No.: N1085-00251  
[TSMC2003-0834]  
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**REMARKS/ARGUMENTS**

**MAR 05 2008**

Claims 1-22 were previously pending in this application and each of claims 1-22 was rejected. Claims 1, 9-12, 14 and 17-19 are amended in this paper, and claim 2 canceled. Applicants respectfully request re-examination, reconsideration and 5 allowance of each of pending claims 1 and 3-22.

Applicants take this opportunity to thank Examiner Jennifer L. Norton for the opportunity given Applicants' undersigned counsel, Mark J. Marcelli, to discuss the application in a telephonic Examiner Interview that took place on February 27, 2008. In particular, the amendments to claims 1 and 12 filed herein, were discussed in the 10 aforementioned Examiner Interview, such claim amendments forwarded to the Examiner in draft form, for consideration on February 15, 2008.

This paper is filed in response to the final Official action mailed November 5, 2007, further to Applicants' previously-filed Response of January 2, 2008, and responsive to the Advisory Action issued January 28, 2008 and the aforementioned 15 Examiner Interview.

**I. Claim Rejections - 35 U.S.C. § 103**

In paragraph 3 of the November 5, 2007 Office action, claims 1-4 and 9-11 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,409,538 to Nakayama in view of U.S. Patent Publication No. 2004/0092047 to 20 Lymberopoulos.

In paragraph 11 of the subject Office action, claims 5-8 and 12-22 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nakayama in view of Lymberopoulos and further in view of U.S. Patent No. 6,798,529 to Saka.

Applicants respectfully submit that each of these claim rejections is overcome for 25 reasons set forth below.

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Claims 1 and 12 represent the independent claims. Independent claim 1 recites the features of:

5 controlling the exposure energy with a feedback process control signal of critical dimension . . . the critical dimension being one of a width, a spacing and an opening of the patterned wafer substrate.

Independent claim 12 recites the features of:

10 a feedback controller providing a feedback exposure energy control signal to the exposure apparatus based on critical dimension measurements . . . , the critical dimension being one of a width, a spacing and an opening of the . . . patterned wafer substrate.

15 As discussed in Applicants' previous Response filed January 2, 2008 and during the Examiner Interview, Nakayama fails to teach any critical dimension, CD signals (i.e. a width, a spacing or an opening) whatsoever, much less using a CD signal to control exposure energy. Moreover, Nakayama does not teach the feature of feedback signals, much less feedback signals of CD or feedback signals directed to an exposure apparatus. Nakayama is limited to using feed forward signals based on optical properties of a film such as reflectivity, refractive index, transmittance, polarization, 20 spectral transmittance and absorption coefficient. As in FIG. 18 of Nakayama, the projection aligner 58 (i.e. the exposure apparatus) has no feedback signals directed to it, only feed forward signals.

25 The Lymberopoulos reference is relied upon for establishing that CD measurements can be made and used in processing operations. Lymberopoulos, however, provides no feed forward or feedback signal to the exposure apparatus. In fact, Applicants respectfully submit that Lymberopoulos teaches away from using the CD's to change exposure energy or otherwise control an exposure apparatus because Lymberopoulos calibrates the CD's and then adjusts subsequent processing operations, e.g., an etch operation, taking into account the measured CD's. Since Lymberopoulos 30 adjusts subsequent processing operations to compensate for the CD's that

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Lymberopoulos simply accepts, there is no need or suggestion in Lymberopoulos to provide a CD or any other signal to an exposure apparatus to change the exposure settings to bring about preferred CD's produced by the exposure apparatus.

It would not be obvious, as the Examiner contends in the Advisory Action, to 5 modify the teachings of Nakayama to include using CD data from a patterned substrate to correct CD variation, because Nakayama provides no feedback signal to projection aligner 58, such as might come from a patterned wafer. Lymberopoulos also fails to provide this feature. There would be no motivation to combine the teachings of Nakayama and Lymberopoulos because Nakayama uses only pre-exposure data and 10 feed forward signals; and post-exposure CD data is not even considered in the Nakayama reference. The use of CD data to control etch operations is simply beyond the scope of the art discussed in Nakayama. When Nakayama discusses an accurate and stable control of pattern size in the projection of a pattern intended, in column 6, lines 15-21, Nakayama talks about controlling these features by monitoring the 15 aforementioned characteristics of the substrate, pre-exposure and providing feed forward signals to the exposure apparatus, i.e. projection aligner 58, in order to provide an exposure setting that *should* provide the accurate and stable pattern size.

On the other hand, there would be no motivation to combine the teachings of Lymberopoulos with a reference that provides desirable CD's out of the exposure 20 apparatus because Lymberopoulos does not require accurate CD's out of the exposure apparatus as Lymberopoulos merely adjusts a subsequent operation responsive to the CD produced by the exposure apparatus.

Even if one did combine the teachings of Nakayama and Lymberopoulos, the above-reproduced claim features distinguish Applicants' invention because the 25 combination provides no feedback to an exposure apparatus and no feedback signal from the CD measurement system. Therefore, the claim features of *controlling the exposure energy with a feedback process control signal of critical dimension as in claim 1 and a feedback controller providing a feedback exposure energy control signal to the*

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*exposure apparatus based on critical dimension measurement* as in claim 12, distinguish Applicants' invention from Nakayama and Lymberopoulos. Claims 1 and 12 are therefore distinguished from Nakayama in view of Lymberopoulos.

Claims 1 and 12 are further distinguished from Nakayama and Lymberopoulos

5 because of the following features recited in the respective claims:

controlling the exposure energy . . . by combining the feed forward control signal with the feedback process control signal to control the exposure energy (claim 1); and

10 wherein a combiner combines the feed forward control signal and the feedback exposure energy control signal to produce a combined signal that is provided to the exposure apparatus (claim 12).

Since there is no teaching or suggestion in the references regarding a feedback CD signal to the exposure apparatus, there is certainly no teaching or suggestion of 15 combining the feed forward control signal and the feedback exposure signal to provide a combined signal that is provided to the exposure apparatus. The combined signal provided to the exposure apparatus of the claimed invention provides an even higher degree of accuracy and CD control because the signal is the combination of two 20 separate signals. This feature is illustrated in FIG. 8 which shows the signal from the feed forward controller 806 combined with the signal from the feedback controller 814 at the combiner designated by the  $\Sigma$  in FIG. 8, and according to the equation FEE(T)=FFEE(T)+FVEE(T-1), as in paragraph [0053] of the originally-filed specification.

In summary, each of claims 1 and 12 is distinguished from Nakayama and Lymberopoulos due to A]] the feature of the feedback process control signal of critical 25 dimension used to control the exposure energy and further distinguished from the references due to B]] the feature of combining the aforementioned feedback CD signal with a feed forward signal to provide a higher level of control.

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The Saka reference, relied upon in rejecting claim 12, is directed to chemical-mechanical polishing and not CD measurement. Saka does not teach measuring a width, spacing or opening of a patterned wafer and therefore does not make up for the above-stated deficiencies of the combination of Nakayama and Lymberopoulos. Claims 5 1 and 12 are each therefore distinguished from the combination of Nakayama and Lymberopoulos, as well as the combination of Nakayama and Lymberopoulos in view of Saka.

Claims 3-11 and 13-22 are each similarly distinguished from the references by virtue of their dependencies from claim 1 or 12. Each of the claim rejections under 10 U.S.C. § 103(a), should therefore be withdrawn.

Applicants point out that claim 19 was amended for editorial purposes. Prior to amendment, claim 19 was identical to claim 20. Claims 9-11 and 14, 17 and 18 were amended to correct typographical errors.

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CONCLUSION

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Based on the foregoing, each of pending claims 1 and 3-22 is in allowable form and the application in condition for allowance, which action is respectfully and expeditiously requested.

5 The Assistant Commissioner for Patents is hereby authorized to charge any fees necessary to give effect to this filing and to credit any excess payment that may be associated with this communication, to Deposit Account 04-1679.

Respectfully submitted,

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Dated: 05 March 2008

  
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